hydrogen gas in atmospheric air, and even, under particular circumstances, from the flame of a common candle, and also from various other inflammable bodies when burning under certain conditions. The author is hence led to the conclusion that this peculiar oxidizing and bleaching principle is produced in all cases of rapid combustion taking place in atmospheric air, and that its production is therefore independent of the nature of the substance which is burnt.

"On the Structure and Development of the Blood.—*First Series.* The development of the Blood-Corpuscle in Insects and other Invertebrata, and its comparison with that of Man and the Vertebrata." By George Newport, Esq., F.R.C.S., President of the Entomological Society, &c. Communicated by P. M. Roget, M.D., Sec. R.S.

The author commences his paper by remarking, that he was led to the present inquiry by some curious facts relating to the blood of insects, which attracted his notice while engaged on the last paper he presented to the Royal Society, on the reproduction of lost parts in insects and myriapoda. Some of these facts he is desirous of making known at once to the Society, preparatory to his offering them more extended researches on the blood of the invertebrata, and its comparison with that of the higher animals.

The chief purpose of the author in the present paper, is to show the analogy which exists between the different corpuscles in the blood of insects and of the vertebrata, to trace the changes which the former undergo as compared with those of the latter, and to show that in development and function they are analogous to secreting cells.

In pursuance of this object, he premises a brief notice of what little was already known respecting the corpuscle in the articulata, and of the different descriptions given of it by Carus, Spence, Wagner, Bowerbank, Edwards, Baly and some later observers, all of whom have described it differently, one only, Mr. Bowerbank, having correctly indicated its form.

He then proceeds to state, that while engaged on other observations in June last, he found that the oat-shaped corpuscles, which are so abundant in the caterpillar state of the insect, almost entirely disappear before the insect has arrived at the perfect, or butterfly state, in which, a few days after the insect is fully developed, scarcely a single oat-shaped corpuscle is to be found; but in the place of these, there are numerous very minute rounded bodies, spherules, and also many flattened, obtusely oval or barrel-shaped, double concave discs. Both these forms of corpuscle have molecular movements, which are most energetic in the spherules.

He next makes some general observations on the composition of the blood of the invertebrata, and calls in question the accuracy of Professor Wagner's view in regarding the blood of these animals as analogous only to the chyle of the vertebrata, at the same time stating his belief that it is not only analogous to true blood, but that it undergoes a continued succession of changes through the agency of the corpuscles. These minute bodies first derive nourishment and

the means of growth and increase from the fluid portion of the blood; and afterwards, when they have become fully developed, undergo dissolution, and help to supply the waste of the fluid that has been expended on the nourishment of the different structures, leaving other little bodies, which also undergo development, to assist in the further elaboration of this fluid. He states also, that the development of these latter bodies appears to have a certain relation to the type of each particular class of animals; and remarks that in the vertebrata the size of the corpuscle is perhaps in a ratio inverse to that of the activity and extent of the function of respiration.

The author states that he has been led to these views, which appear to him to apply to animals generally, by an examination of the corpuscles, and by watching the changes which take place in the blood in lepidopterous insects; and he points out their accordance with those of Wagner, Henle, and Wharton Jones, with regard to the function of the corpuscles; but proposes to give the details on which his own view respecting the size of the corpuscle is founded on a future occasion.

He then enters more particularly on the consideration of the forms of corpuscle in the blood in the Articulata, which he marks as four; although, he observes, they are in reality only so many stages of development of one ultimate structure. These forms are,—first, the *molecules*, which he regards as comparable to the molecules observed in the chyle of Vertebrata by Mr. Gulliver; secondly, the *nucleated* or *oat-shaped corpuscle*, which he believes with Wagner are analogous to the white, or chyle corpuscles of Vertebrata; thirdly, the *spherules*, or minute rounded bodies developed from the oat-shaped corpuscle, and which he believes are analogous to the free nucleoli of Valentin, and probably to the very minute white, opake granules constantly observed in the blood of vertebrata; and lastly, the *discs*, which are further developments of the spherules, and analogous to the true red blood-discs of the higher animals, and which, as he states in a subsequent part of his paper, in his examination of the blood of the human fœtus, he believes that he has also traced from the white, opake granules or spherules.

The author then proceeds to describe these forms of the corpuscle in insects more minutely, and enters into considerable detail with reference to the oat-shaped corpuscle, tracing it from its earliest distinct form, before any nucleus is perceptible in it; and shows that the nucleoli which constitute this body are gradually increased in number, until the corpuscle has attained its full size, when it first changes its form and becomes shorter, then rounded, and afterwards entirely breaks up and liberates the nucleoli that have been developed within it. This change of form he shows always takes place very rapidly in all the oat-shaped corpuscles, large and small, when out of the body, and to this circumstance he attributes the diversity in the descriptions that have been given by various observers of the form of the corpuscle. He shows also, that, with reference to the function of this body, the corpuscles are usually found in greatest number during the act of breaking up, immediately before the larva

is preparing to change its skin, at which time the blood is extremely coagulable; and that there are fewest corpuscles, or that there is the greatest number of small corpuscles of this kind, soon after the caterpillar has again begun to feed. When the insect has assumed the pupa state, nearly the whole of these corpuscles are broken up. The greatest abundance of them is found in the act of changing on the third or fourth day of the pupa, after which the number of these corpuscles is gradually lessened, until, when the insect has entered the perfect state, very few remain. When the change to the perfect insect occurs, there is another opportunity of watching the function of this corpuscle. When the wings are being expanded and still soft, a few oat-shaped corpuscles circulate through them; but as the wings become consolidated, these corpuscles appear to be arrested, and break down in the circulatory passages, supplying directly the material for the consolidation of these structures; as appears from the entire arrest of circulation in these parts, and from the granular remains of the corpuscles which may be seen by transmitted light in a wing completely denuded of its scales on the upper and under surfaces. The spherules and discs of the perfect lepidopterous insect are then noticed; and some peculiar clavate or fiddle-shaped bodies, which appear to be the transition forms between spherules and discs, are pointed out as occurring in the blood of one of the night moths, *Xylophasia polyodon*, and also in the butterfly soon after it has left the pupa state. These facts are regarded as proofs, derived from direct observation, of the function of the corpuscle, and of its analogy, both in function and development, to the secreting cells of glands.

In the second division of his paper, the author draws some comparisons between the blood-corpuscles of insects and the vertebrata, and gives the details of a series of observations on the blood of a human fœtus that was born alive at the end of the sixth month. He examined the blood of the parent, and of the placenta, and also of different parts of the body of the fœtus a few hours after death, and found in general that the blood of the parent contained a very large quantity of white chyle corpuscles, and was extremely coagulable: the blood of the placenta contained, beside an abundance of chyle corpuscles, red blood-discs of extremely variable sizes, the largest being one-third or one-fourth larger than those of the mother, and the smallest scarcely more than one-fourth as large as the largest. There were also an immense abundance of molecules and nucleoli, from which latter the red blood-discs appeared to be developed. The blood of the vein and lungs presented a similar irregular condition as to size of the corpuscles, while that of the left auricle of the heart, aorta and arteries of the cord was more uniform in its character. From these observations the author concludes, that the blood of the vertebrata is analogous in its mode of development to that of the insects and other invertebrata, and that the red blood-discs are the ultimate developments of the opake white granules or nucleoli of the blood.

Drawings illustrating the subjects accompany the paper.